

# Math 110 Mathematical Investigations

## 1.2 Percents and Proportional Relationships: Class Activity

Name: Mike

**Instructions:** Show all your work and, when appropriate, be sure to include units and write your answer in a complete sentence.

### Percents.

1. Write each as a <sup>percentage</sup> percent:

(a)  $0.1234 = 12.34\%$

(b)  $\frac{7}{32} = 21.875\%$

(c)  $4\frac{2}{3} = \cancel{417\%} 466.\bar{6}\% \approx 467\%$

2. A restaurant is putting in an advertising campaign which they hope will increase their number of customers by 15%. They currently have about 60 customers a day. How many customers will they have if their campaign is successful?

$$60(1.15) = 69 \text{ customers total}$$

3. The local zoo has 15 male penguins and 20 female penguins. What percent of the penguins are male?

There are 35 penguins total.

$$\frac{15}{35} \approx 42.857\% \text{ of the penguins are male}$$

4. The computer I want originally cost \$2,500.00. If I get an end-of-the-year deal worth 25% off, how much will I pay for the computer if sales tax is 7%? Assume the tax only applies to the discounted price, not the original price.

$$(\$2500(75\%))(107\%) = \$2006.25$$

↑                      ↑  
25% off                      tax is 7% more

### Ratio and Proportions.

Solve Problems 5–7 using proportional reasoning. This may include setting up a proportion or other method. Regardless of your method, be sure to show all your work and/or explain your thinking.

5. Yesterday, I put 8 gallons of gas in my car, and I paid \$36. A couple hours after, I went back to the gas station with my dad's car and after filling up the tank, I paid \$18. How many gallons of gas did I put in my dad's car?

$$\frac{8}{36} = \frac{?}{18}$$

Since 18 is half of 36, ? is half of 8.  
They put 4 gallons in.

6. A highway had a landslide where 4,000 cubic yards of material fell on the road, requiring 250 dump truck loads to clear. On another highway, a slide left 50,000 cubic yards on the road. How many dump truck loads would be needed to clear this slide?

$$\frac{4000}{250} = \frac{50000}{?} \Rightarrow ? = \frac{50000 \cdot 250}{4000} = 3125 \text{ trucks}$$

7. Honey contains 21 calories per teaspoon. How many calories are in 2 cups of honey? You may use your phone to look up the necessary unit conversions.

$$\frac{21 \text{ calories}}{1 \text{ tsp}} = \frac{? \text{ calories}}{2 \text{ cups}}$$

Note 2 cups = 96 tsp

$$\Rightarrow \frac{21}{1} = \frac{?}{96} \Rightarrow ? = 2016 \text{ calories}$$

### Absolute Change and Relative Change.

Given two quantities, the absolute and relative changes between those quantities are given by:

Absolute change = |ending quantity – starting quantity|

Relative (or percent) change =  $\frac{\text{absolute change}}{\text{starting quantity}}$

Note that the absolute change has the same units as the original quantity while relative change gives a percent change.

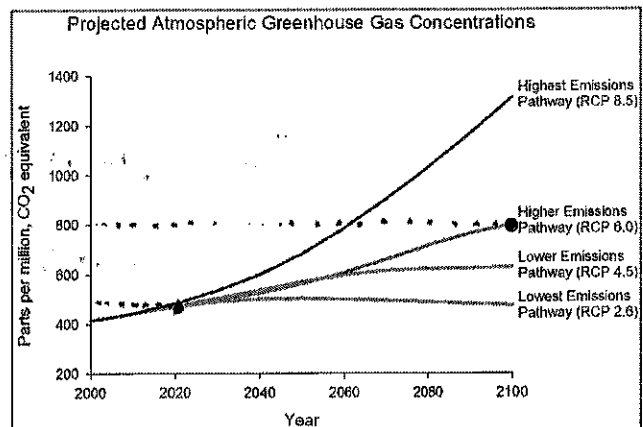
8. How much will greenhouse gases increase in the coming years? This figure shows projected greenhouse gas concentrations for four different emissions pathways. Source: Graph created from data in the Representative Concentration Pathways Database (Version 2.0.5) <http://www.iiasa.ac.at/web-apps/tnt/RcpDb>

- (a) Using the “Higher Emissions Pathway”, find the predicted absolute change in  $CO_2$  levels from 2000 to 2100.

estimating  
 $|800 - 450| = 350 \text{ ppm increase}$

- (b) Using the “Higher Emissions Pathway”, find the predicted relative (percent) change in  $CO_2$  levels from 2000 to 2100.

$$\frac{350}{450} \approx 78\% \text{ increase.}$$



## Application of Proportions – Grade Calculation.

When your grade is based on total points, you take the points you have earned and divided this by the total number of points in the course to find your percent grade.

Example: If you earn 3400 points out of a total of 5000 points, then your grade is  $3400/5000 = .68$ , or a 68%.

In some classes, not all grades are weighted equally. Grades on some assignments have a greater impact on the final course grade than others. To calculate a weighted grade, first multiply the weight (after converting the percent to a decimal) by the score earned for that category. Repeat this for each category. Then add these together to find the final grade.

Example: If homework is 20% of your grade and the final exam is 80% of your grade, and you earn a 93 on your homework and a 61 on your final exam, your grade is  $93 (.20) + 61 (.80) = 67.4$ , or a 67.4%.

9. Angelica is taking a history class where her grade is based on the total number of points earned. The total number of points available in this course is 2400. How many points would she need to earn to get a 70% for the semester?

$$2400 (70\%) = 2400 \left(\frac{70}{100}\right) = 24 \cdot 70 = 1680 \text{ points}$$

10. Hikaru is taking an algebra class and the grade is weighted according to the structure given here.

Grading Weight Structure	
Homework	20%
Quizzes	10%
Exam 1	15%
Exam 2	15%
Final Exam	40%

- (a) Suppose Hikaru works hard on the homework and earns a 99. His quiz score is a 78, he earned an 84 on the first exam and a 75 on the second exam, and his final exam score was a 72. Is this enough for Hikaru to earn a B in the class? What is his overall grade?

$$99(20\%) + 78(10\%) + 84(15\%) + 75(15\%) + 72(40\%)$$

$$= 19.8 + 7.8 + 12.6 + 11.25 + 28.8 = 80.25$$

Barely got a B

- (b) Joseph is in the same class and understands the material pretty well but has not completed much of the homework. Suppose his grades are as follows: Homework 29, Quizzes 80, First Exam 83, Second Exam 77. If he scores a 70 on the Final Exam, will he be able to pass the class with a C?

$$29(20\%) + 80(10\%) + 83(15\%) + 77(15\%) + 70(40\%)$$

$$= 5.8 + 8 + 12.45 + 11.55 + 28 = 65.80$$

Joseph got a D

Challenge Problems

See Mike if you want to compare approaches

11. Wildlife biologists catch, tag, and then release 115 deer back into a wildlife refuge. Two weeks later they observed a sample of 120 deer, 25 of which are tagged. Assuming the ratio of tagged deer in the sample holds for all deer in the refuge, approximately how many deer are in the refuge?

552 deer

12. Suppose the selling price of a 2019 Tesla Model S 75D is \$72,000. If the markup is 10% of the dealer's cost, what is the dealer's cost?

strange wording

approximately  
\$ 65,454.55

13. If you drive at a speed of 80 miles per hour, how many minutes will it take to travel 100 miles?

75 minutes

14. Suppose the U.S. national debt is about \$17 trillion. That's a very large number and can be difficult to comprehend. The U.S. population is around 320 million people but assume about 22% of that number consists of children. If we distributed this debt to each U.S. adult, then how much debt would each adult owe?

approximately  
\$241,477.27

15. Use your course syllabus to calculate your overall grade given the following scenario. For online homework you earn a 75, for Chapter Assessments you earn a 65, for content checks you earn a 82, for the mid-term project you earn an 80, for the final project you earn a 79, and for participation and citizenship you earn a 100. What is your course grade?

